

Lessons Learned

First Degree Sunburn from UV Transilluminator.

An employee was using an ultraviolet (UV) Transilluminator to visualize DNA bands on a series of agarose gels. The employee wore a lab coat, UV protective eyewear and latex gloves, but not a face shield. With the cover of the light box open and the UV light source on, the worker placed a gel on the glass and marked the desired bands. The gel was then removed, the light box cover closed, and the gel placed on the cover. The appropriate bands were then cut out of the gel. The procedure was repeated a total of four times. This entire process took approximately 25 minutes. The estimated exposure time with the lid of the transilluminator open was 3 minutes.

Upon completion of the procedure the worker's face itched. Some redness was noted when the worker went home, and a topical aloe ointment was applied. When the worker returned to work the next day a co-worker noticed the sunburn. The worker reported to the Medical Department.

Industrial Hygiene was called and took measurements of the UV light source. Readings with the shield lid closed were <0.02 microwatts/cm² at contact with the lid. Readings with the lid open were 200 microwatts/cm² at 18 inches above the lamp. At the intensity with the lid open the ACGIH TLV would be exceeded in 15 seconds of exposure.

The transilluminator was a typical model where UV light passes through a clear glass plate. Gels and other biological samples are placed on this plate for visualization of the fluorescence. A second clear plastic safety cover or lid, when closed, filters out the intense and tissue damaging UV light. The transilluminator did contain a clearly visible warning label that read, "*Caution. This safety cover blocks ultraviolet radiation. For your protection do not operate unit unless this safety cover is in place or you are wearing appropriate eye and skin protection.*".

UV RADIATION AND EXPOSURE HAZARDS

Ultraviolet light (UV) is non-ionizing radiation in the 180 to 400-nanometer wavelength region of the electromagnetic spectrum.

The ultraviolet spectrum is commonly divided into the following three regions:

Region	Region Name	Wavelength (nm)
UVA	Black Light	315-400
UVB	Erythral	280-314
UVC	Germicidal	180-280

Exposure to ultraviolet radiation is typically limited to the UVA region resulting from exposure to direct sunlight. The Earth's atmosphere shields us from the more harmful UVC and greater than 99%

of UVB radiation. Equipment such as transilluminators, germicidal lamps, biosafety cabinets and crosslinkers can generate concentrated UV radiation in all the spectral regions that, if used without the appropriate shielding and personal protective equipment, can cause injury with only a few seconds of exposure.

An unfortunate property of UV radiation is that there are no immediate warning symptoms to indicate overexposure. Symptoms of overexposure including varying degrees of erythema (sunburn) or photokeratitis (welder's flash) typically appear hours after exposure has occurred.

Skin Injury - UV radiation can initiate a photochemical reaction called erythema within exposed skin. This “sunburn” can be quite severe and can occur as a result of only a few seconds exposure. It may or may not feel like a tingling sensation. Effects are exaggerated for skin photosensitized by agents such as coal tar products, certain foods (e.g., celery root), certain medications, photoallergens and pregnancy. Chronic skin exposure to UV radiation has been linked to premature skin aging, wrinkles and skin cancer.

Eye Injury – UV radiation exposure can injure the cornea, the outer protective coating of the eye. Photokeratitis is a painful inflammation of the eye caused by UV radiation-induced lesions on the cornea. Symptoms include a sensation of sand in the eye that may last up to two days. Chronic exposures to acute high-energy UV radiation can lead to the formation of cataracts.

SPECIAL WORK PRACTICES

Never allow the skin or eyes to be exposed to UV radiation sources. The UV radiation generated by laboratory equipment, such as unfiltered transilluminator light, can exceed recommended exposure limits and cause injury with exposures as brief as three seconds in duration. Especially in the case of safety cabinets or open UV sources, the room itself should be posted with respect to the UV hazard and entry requirements.

Biological Safety Cabinets – Never work in a biological safety cabinet while the germicidal lamp is on. The lamp should also never be on while workers are in the room. Reflections off polished or bright surfaces can still cause exposure.

Transilluminators – Transilluminators should be used with the protective shield or cover in place whenever possible. All protective shields must be kept clean and replaced when damaged. If there is a need to work with the protective cover open, the user must wear appropriate PPE. With respect to other employees that are present in the room the user has three choices: 1.) Post the room to warn that UV radiation exposure is possible and restrict entry; ask all other personnel to leave the room, 2.) Post the room; require any remaining workers in the room to wear appropriate PPE. 3.) Isolate the transilluminator so that all other personnel are always shielded from any UV light exposure.

Crosslinkers – Crosslinkers must not be used if the door safety interlock is not working properly.

EQUIPMENT LABELING

Many overexposures to UV radiation have occurred as a result of individuals not knowing the hazards associated with UV-emitting equipment. To help prevent eye and skin injuries, any equipment that

emits UV radiation must be conspicuously labeled with a caution label. The label should contain language similar to:

**CAUTION
UV RADIATION HAZARD
USE PROPER PPE:
GOGGLES OR FACE SHIELD, LAB COAT, GLOVES**

Caution labels are available from Industrial Hygiene or may be available from the manufacturer of the UV light product.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Protective Clothing: Wear standard laboratory apparel including a fully buttoned lab coat, long pants and closed toe shoes. While working with UV radiation sources, lab workers must be particularly vigilant to prevent gaps in protective clothing that commonly occur around the neck and wrist areas.

Eye/Face Protection: If there is any potential for the eyes and face to be exposed to UV radiation, a polycarbonate face shield stamped with the ANSI Z87.1-1989 UV certification must be worn to protect the eyes and face. Ordinary prescription eyeglasses may not block UV radiation. UV certified goggles and safety glasses will protect the eyes, but it is common for lab workers to suffer facial burns in the areas not covered by the goggles or glasses.

Gloves: Wear disposable nitrile gloves to protect exposed skin on the hands. Ensure wrists and forearms are covered between the tops of gloves and the bottom of the lab coat sleeves.

INDUSTRIAL HYGIENE UV LIGHT/RADIATION SERVICES

Measurements: IH has instrumentation to accurately measure UV radiation generated by laboratory equipment. Based upon the strength of the UV radiation source and the duration of worker exposure, they can provide information on recommended occupational exposure limits. IH can also confirm the performance of safety equipment including equipment shielding and personal protective equipment.

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